Space Weather Technical Forecast

Issued on Saturday, 06 August 2022 at 12:25 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: G1/Minor geomagnetic storms possible next 24 hours due to high speed stream activity. Slight chance of M-class flares ith R1-R2 Radio blackouts throughout. Chance of Active (1e8 integrated pfu) fluence by Day 3 .

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low over the past 24 hours with isolated C-class flares. There are currently five numbered regions on the disc, most of which are small, weak and appear magnetically stable. A new region has recently emerged in the northeast quadrant, and is classified Axx/Alpha. The largest region on the visible disc continues to be AR3068 (Cai/beta) and has shown only minor activity so far. A CME observed from a flare at 05/0644UTC from one of the regions in the southwest quadrant. Analysis of this event is difficult due to lack of imagery, but it is currently considered unlikely to be Earth directed.

Solar Wind / Geomagnetic Activity: The solar wind, as measured by DSCOVR at L1, started at slightly elevated levels under a waning high speed stream from coronal hole 07 and is now slow--ambient. Density was mostly near average throughout with a rising trend to around 9ppcc in recent hours. The total IMF, Bt, was weak with a peak around 6nT. The north-south component, Bz, fluctuated weakly between +5/-5 nT. The Phi angle was mostly negative (towards the Sun). Geomagnetic activity was Quiet (Kp 0-2).

Energetic Particles / Solar Radiation: The high energy proton flux (10 MeV), as measured by GOES-16 was at background levels. The high energy electron flux (greater than 2 MeV) was at background to moderate levels. Electron fluence was well below the Active (1e8 integrated pfu) threshold and showed a general fall in activity. Observed fluence was 1.73e6 integrated pfu at 06/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Low or very low solar activity is forecast with a slight chance of an M-class flare. Potential new active regions may rotate onto the disc in the next couple of days, increasing flare probabilities slightly, although AR3068 will rotate off on Day 4 (09 Aug).
Solar Wind / Geomagnetic Activity: The CME (Coronal Mass Ejection) observed from one of the regions in the southwest quadrant is currently considered unlikely to be Earth directed. Solar winds starting slow-ambient around 350 km/s. In the next 12 to 24 hours a new HSS (High Speed Stream) is expected to arrive, from CH09/+, with wind speeds of 500-550 km/s likely. Wind speeds from this feature are expected to slowly ease through Day 3 (08 Aug), before a further increase is likely on Day 4 (09 Aug) from CH10/+.
Geomagnetic activity starting this forecast period Quiet before becoming Unsettled to Active later Day 1 and into Day 2, with a slight chance of isolated G1/Minor Storm intervals occurring. Activity should decline through Days 2 and 3 to mainly Quiet, before another increase on Day 4 with a chance of G1 intervals once again.

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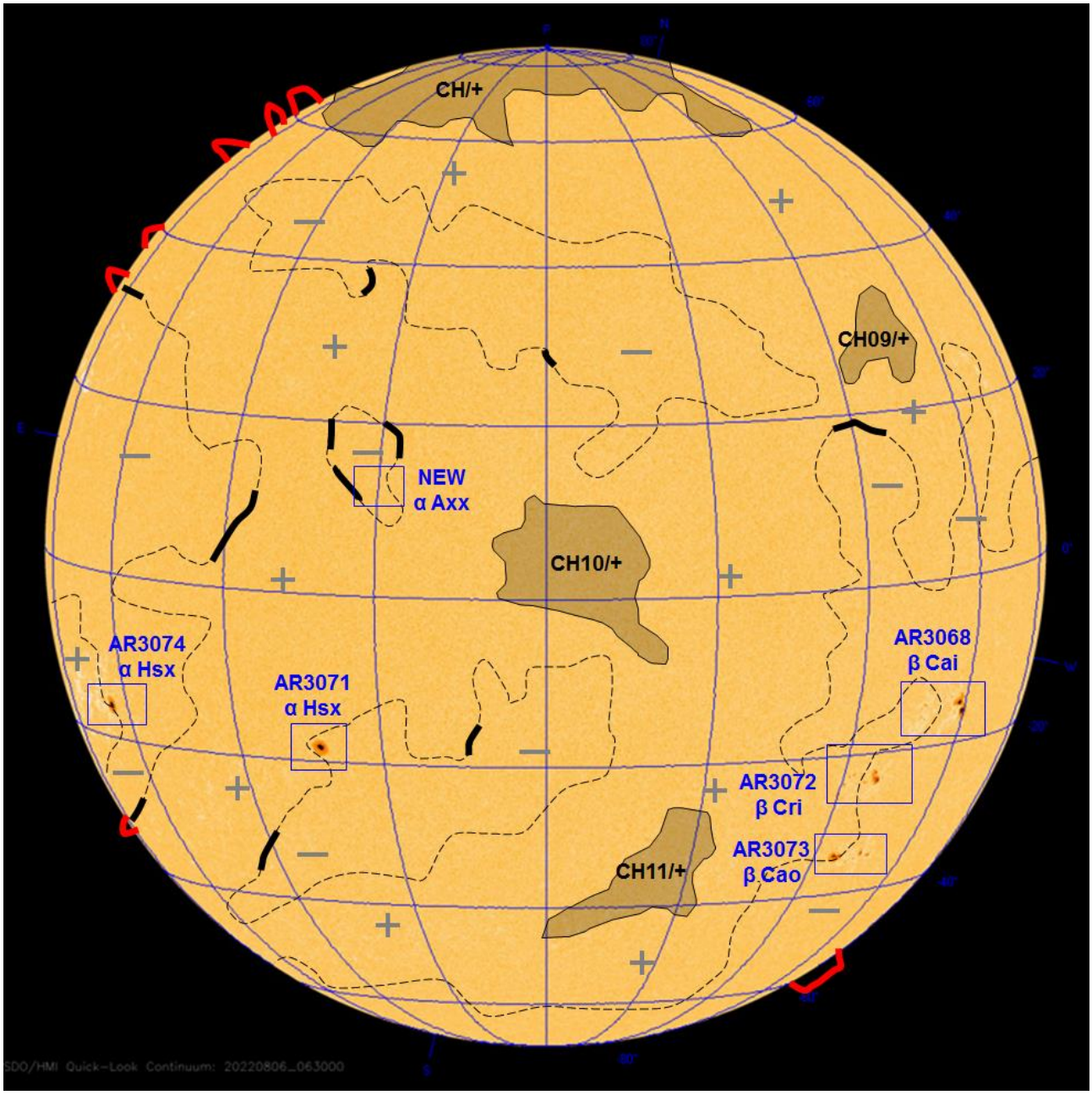
Met Office Space Weather Technical Forecast

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) is expected to remain at background levels. The high energy electron flux (greater than 2 MeV) may increase through the period to reach high levels at the diurnal maxima by Days 3 and 4 (08-09 Aug). The corresponding 24 hour fluence is likely to show an increasing trend through Days 3 and 4 with a chance of reaching Active (1e8 integrated pfu) levels at this time.

Figure 1. Solar Analysis Valid 0800UTC, 6 August 2022.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

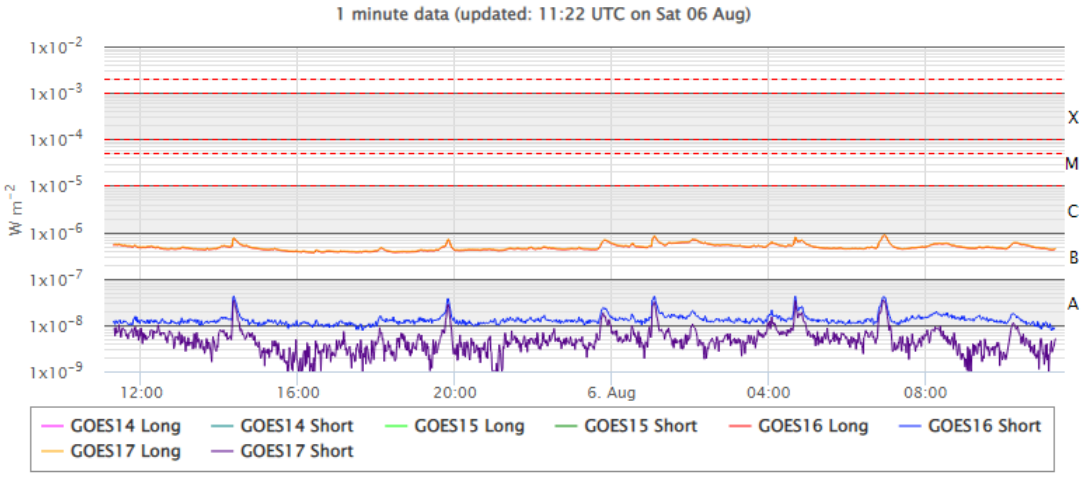
A CME was observed associated with a flare at 05/0644UTC from one of the regions in the southwest quadrant. Analysis of this event is difficult due to lack of imagery, but it is currently considered unlikely to be Earth directed. Earth is currently gradually exiting the High Speed Stream of CH07/-, with wind speeds now around 350 km/s. Then from later on Day 1 (06 Aug) a new HSS is expected to arrive, from CH09/+. Although this feature appears weak in imagery, recent data from STEREO-A indicates that solar wind speeds of 500-550 km/s are likely, following a potentially reasonably significant CIR (Co-rotating interaction region). There are signs from observational data at L1 that the CIR may be due quite soon with an increase in density over recent hours. Wind speeds from this feature are expected to slowly ease through Day 3 (08 Aug), before a further increase is likely on Day 4 (09 Aug) from CH10/+.
Geomagnetic activity starting Quiet before becoming Unsettled to Active later Day 1 and into Day 2, with a chance of isolated G1/Minor Storm intervals occurring. Activity should decline through Days 2 and 3 to mainly Quiet, before another increase on Day 4 with a slight chance (10%) of a G1 interval once again.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	30	40	5	10
Strong	G3	No	1	5	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Nil.

Figure 2: X-ray flux plot at GEO with isolated C-class flares over past 24 hours.



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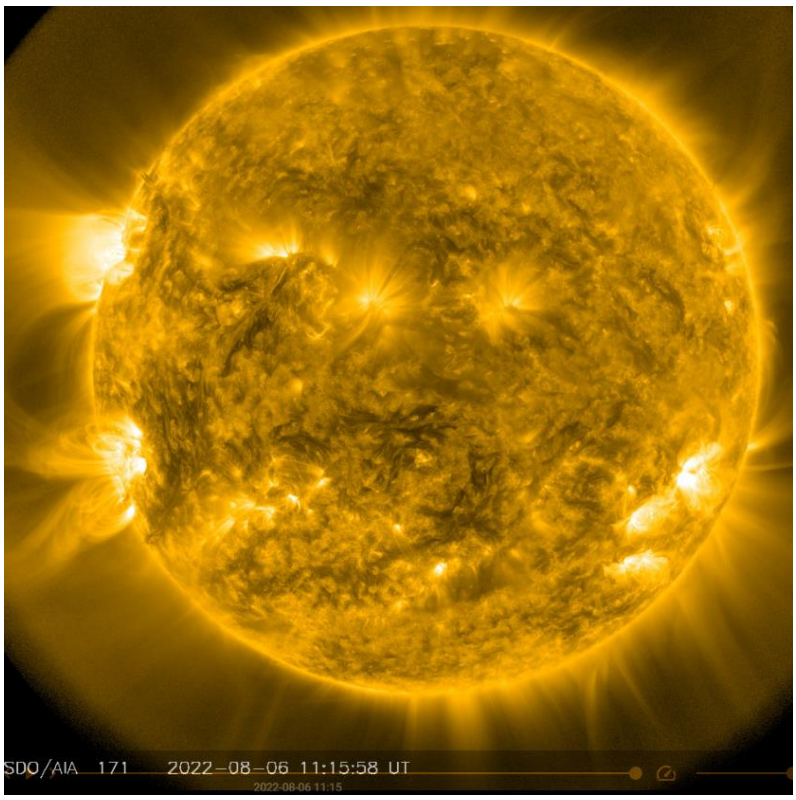
Radio Blackouts - X-Ray Flares:

Solar activity has been Low over the past 24 hours with isolated C-class flares. There are five numbered regions and one unnumbered region on the visible disc, most of which currently appear to be weak and magnetically stable. The largest region on the visible disc continues to be AR3068, (now Cai/Beta) which appears largely stable. Two further regions in the southwest quadrant, AR3072 (Cri/Beta) and AR3073 (Cao/Beta) appear mostly small and stable. There are also two Hsx/Alpha regions in the southeast. The newly emerged and very small sunspot is unipolar and in the northeast quadrant Axx/alpha.

Low or very low solar activity is likely to continue with a slight chance of an M-class flare. STEREO-A imagery suggests that there are potential new regions due to rotate onto the visible side of the sun's disc in the next couple of days. It is difficult to assess these regions until they become visible, so just a slight increase in flare probability is indicated. However, AR3068 will also rotate off the disc on Day 4 (09 Aug), and this re-balances the probabilities.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	15	20	25	25
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: SDO-aia 171 image of the visible side of the sun's disc at 06/1115UTC



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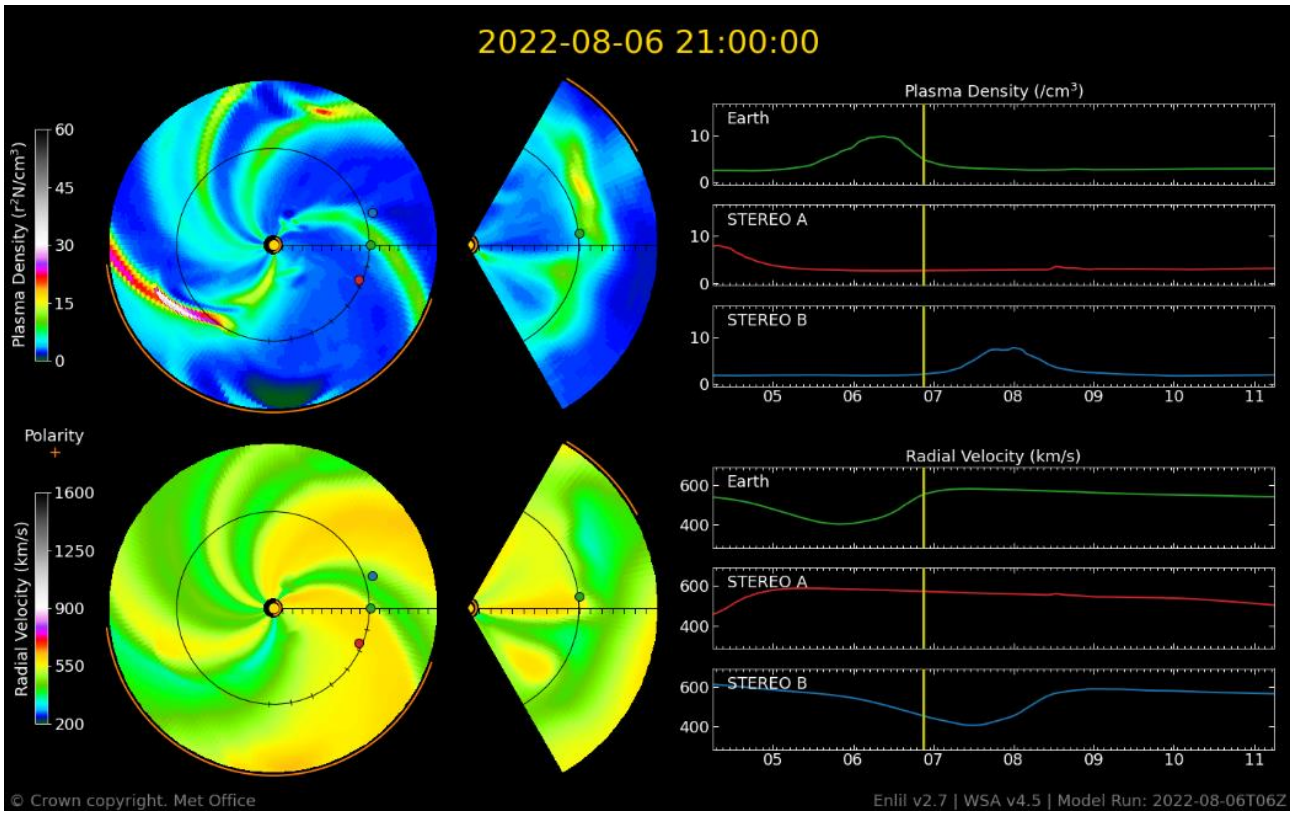
Solar Radiation Storms - (High Energy Protons):
The high energy proton flux (greater than 10 MeV) is currently at Background levels and is expected to remain at this level through the period. The spots in the southwest will need monitoring for any further development, however, as the western hemisphere of the solar disc is where radiation events are more likely to connect with Earth.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	1	1
Very Active	**≥ S3 ***	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

Figure 4: Met Office ENLIL model with the HSS probably established later on 6 Aug, but magnitude may be a little too high with solar winds 500-550 km/s more likely.



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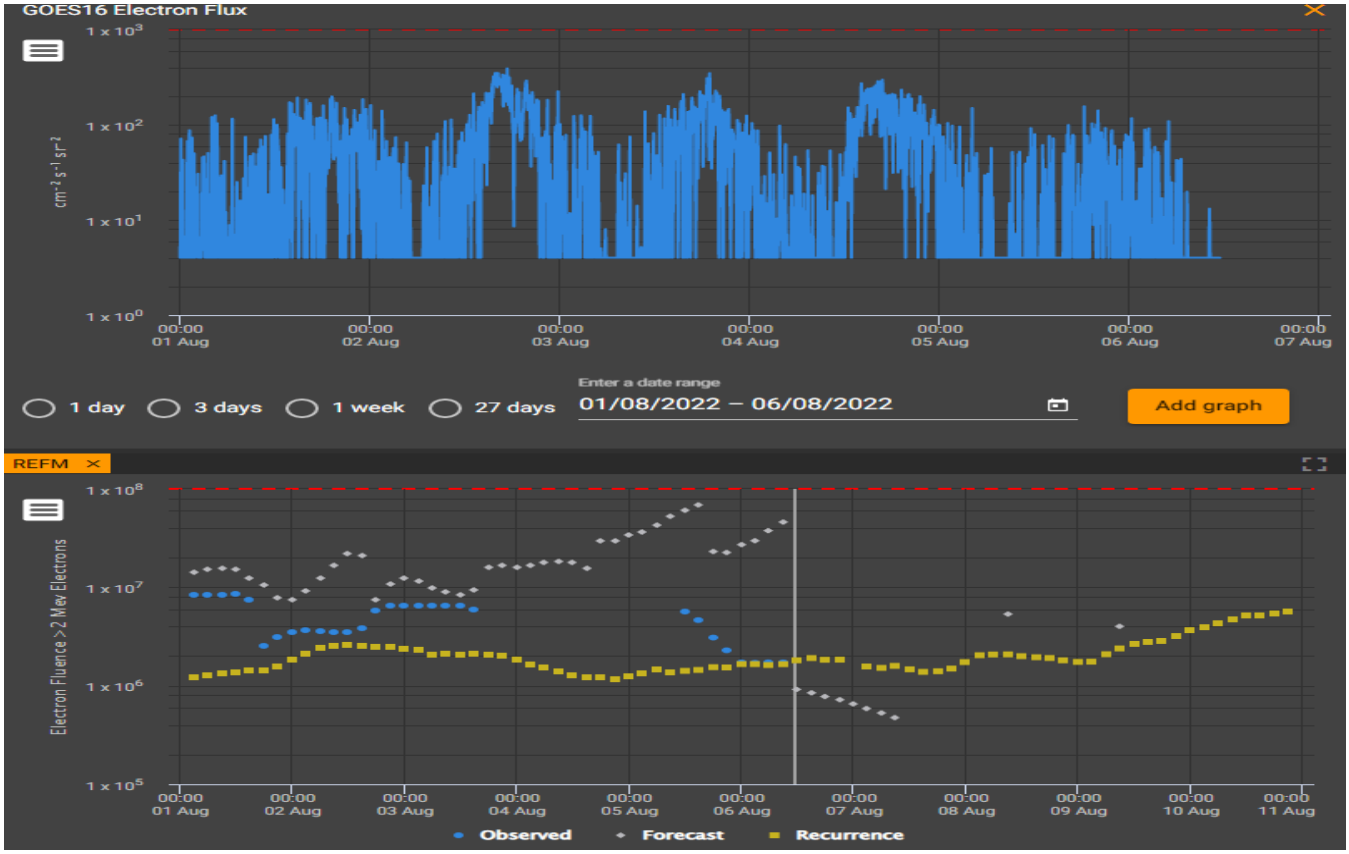
High Energy Electrons Event (≥ 2MeV):

The high energy electron flux (greater than 2 MeV) as measured by GOES-16, is expected to initially be at background levels, but may increase through the period to reach high levels at the diurnal maxima by Days 3 and 4 (08-09 Aug). This is due to a likely increase in wind speeds through Days 1 and 2 from a high speed stream potentially driving some electron charging. The corresponding 24 hour fluence is expected to remain below the Active threshold (1e8 integrated pfu) at first, with an increasing trend possible through Days 3 and 4 and a chance of reaching Active levels at this time.

The Met Office REFM is unlikely to be taking account of the increase in wind speeds early in this period with significant differences from the previous rotation apparent. As such the early part of the period is reasonable, but fluence levels are likely under forecast later in the period.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	10	30	40
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 5: High energy electrons at GEO and Met Office REFM output since the start of the month.



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